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TITLE: Energy conversion apparatus

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Abstract Text - ABTX (1):

An energy conversion apparatus for converting forces occuring in nature to electrical energy. Natural forces such as wind, gravity, etc. are **converted to reciprocating linear motion which is then converted to electricity either directly or after a linear to rotary motion** conversion.

Brief Summary Text - BSTX (6):

Basically the system of the present invention takes a force such as wind or waves or similar type of force to be described below which is generally cyclic or periodic and **converts it to a linear motion**. The linear motion is then in some cases used directly to generate electrical energy through the use of a linear generator or is first converted to rotary motion for that purpose. Various embodiments are shown in which the electricity may be stored and converted from DC to AC. Various specific embodiments are illustrated, in particular, an embodiment in which wind forces are used to obtain the linear motion is shown. In this embodiment a specially designed sail having a plurality of flaps adapted to open at various wind velocities is secured to a shaft which is mounted for linear motion and is forced inward by the wind and returned by a spring. The device relies on the fact that generally some variation in wind will be experienced and also makes use of

the flaps included
therein which will alternatingly open and close to cause the sail and its shaft
to reciprocate in and out. Another embodiment employs a hydraulic system
located under a road or possibly under a sidewalk or the like in which the
gravitational forces of automobiles or people passing over the hydraulic
section generate the force to move a shaft on the end of a piston. Obviously,
on heavily traveled roads or sidewalks such a device will generate a continuous
supply of electricity.

Brief Summary Text - BSTX (7):
Various means of **converting linear motion to rotational motion** are shown as
are various output arrangements.

Drawing Description Text - DRTX (6):
FIG. 5a is a similar diagram illustrating a system in which the **linear
motion is converted** to rotary motion to drive a conventional generator.

Drawing Description Text - DRTX (13):
FIG. 8 illustrates another embodiment for **converting linear to rotary
motion**.

Detailed Description Text - DETX (2):
FIG. 1 illustrates in basic block diagram form the essential elements of the
system of the present invention. These comprise a means 11 which is capable of
converting a naturally existing force such as wind, waves, tides, etc. into
reciprocating or oscillating linear motion. A second block 13 is one which
comprises means capable of **converting the linear motion** into an electrical
output. As will be described in more detail below, such

means may comprise a
linear motor.

Detailed Description Text - DETX (3):
FIG. 2 illustrates in block diagram form a more detailed arrangement. As in
FIG. 1, means to **convert a natural force into periodic linear motion** and
designated by 11 is shown. The means of block 13 for **converting the linear**
motion into electricity are shown as comprising a block 15 for **converting the**
linear motion to rotary motion and a block 17 for converting the rotary motion
to electrical energy. Such means will be described in detail below. The
rotary to electrical energy means may comprise a conventional AC or DC
generator. Also illustrated on FIG. 2 is a block 19 with dotted arrows from
block 15 and to block 17. Block 19 represents a mechanical device for energy
storage such as a **flywheel** or the like. Thus, as indicated, between the linear
to rotary conversion means and the means for generating electrical energy 17,
such a **flywheel** may be installed to smooth out the pulsating reciprocal motion
obtained from the force to linear conversion means.

Detailed Description Text - DETX (5):
FIG. 4 illustrates an embodiment in which a linear generator is used. As
shown on the Figure means 31 which may comprise a wind sale such as will be
described below or any other means for **converting existing forces into linear**
motion will have a periodic force applied thereto. The plate 31 is rigidly
coupled to a shaft 33 supported in bearing means 35 in conventional fashion.
The other end of the shaft is shown as having a plate rigidly coupled thereto
which is spring biased against the direction of the force by one or more

springs 37 which are placed between the plate 36 and a rigid structure 38.
Mounted to the shaft 33 for movement therewith is the rotor 41 of a linear
generator. The rotor 41 will cooperate with stator portions 43 in conventional
fashion to provide an electrical output on line 45. This electrical output may
then be used in the manner described above in connection with FIG. 3. In
operation the periodic force will push in on the plate 31 moving the shaft 33
therewith causing electricity to be generated in the linear generator. Because
of the periodic nature of the force or because of the design of the plate 31 in
the case of the wind sail to be described below the plate will thereafter under
the force of springs 37 return to its initial position again generating
electrical energy. Force will be applied to the plate pushing it in. Such
reciprocation will continue as long as the forces are present causing an output
of electricity to be continually generated.

Detailed Description Text - DETX (6):
FIG. 5a illustrates an embodiment in which the **linear motion is first converted** into rotary motion. As in the embodiment of FIG. 4 the shaft 33 is
coupled to the plate 31 and is supported in suitable bearing means 35. The end
of the shaft away from the plate 31 will be threaded as a worm gear or in some
cases may simply be a twisted rod, twisted in the nature of the rod associated
with a top. This is indicated by the threaded portion 45 on the drawing. The
threads 45 will engage surface threads in a member 47. Member 47 is not
rotationally restrained in any manner. On its rear edge it will contain clutch
or ratchet means adapted to engage only when the member 47 is being turned by
linear motion in the direction of arrow 49. Member 47 thus selectively engages

the end 51 of the shaft 53 of a generator 55. As shown, the generator shaft is
at least partially hollow to accept the end of shaft 33. The second bearing 35
is within shaft 53. Alternatively, through proper machining, the shaft 53 can
act as the second bearing sufface for the shaft 33. A spring 57 is provided
between the end of shaft 33 and a fixed portion in shaft 53 to provide the
restoring force to shaft and the plate 31. The generator 55 may have its rotor
act as the **flywheel** to smooth out motion. Alternately an additional **flywheel**
as indicated by FIG. 2 may be installed. During outward motion under the force
of spring 57 the members 47 and 51 will disengage allowing shaft 53 to
free-wheel. Springs 58 are provided to cause member 47 to be slightly biased
towards member 51 so that they will immediately engage when the force in the
direction of arrow 49 is applied.

Detailed Description Text - DETX (7):

FIG. 5b illustrates a perspective view of an embodiment according to FIG.
5a. A sail 31 such as those to be described below is attached to the end of a
shaft 33 which shaft comprises a twisted rod, twisted much in the manner of the
rod associated with a spinning top. The rod 33 is supported by a bearing 35
along with a bearing 36 in the housing 38 of the generating equipment. The
shaft 33 engages a member 47 which contains a slot 46 which is shaped to mate
with shaft or rod 33. Linear motion of the shaft 33 will thus result in
rotation of member 47. The inside end of member 47 is made with jagged
projections 52 all of which point in one direction. These engage similar
projections 54 on the end of a shaft 53 coupled to a **flywheel** 60, the output
shaft 62 of which may then be used to drive the generator of FIG. 5a. The

orientation of the projections 52 and 54 result in coupling only on the inward stroke. In addition they prevent transmittal of force from the **flywheel** 60 to the shaft 33 should the **flywheel** speed exceed the shaft rotational speed. Shaft 53 is hollow to accept the end of the shaft 33 and contains a spring 57 therein which is adapted to press against the end of the shaft 33 and bias it outwards. As described above, a spring 58 is provided to insure that engagement of member 47 and shaft 53 occurs immediately upon the inward motion of shaft 33. Operation is as described above in connection with FIG. 5a.

Detailed Description Text - DETX (8):

FIG. 6a illustrates a typical embodiment of a plate 31 such as may be used for **converting wind forces into linear motion**. The plate generally designated as 61 and to which the shaft 33 is rigidly coupled comprises a solid upper section 63 having the shaft 33 coupled thereto with a plurality of hinged flaps 65 on its lower section. The flaps will be of different size and weight and may have additional weights placed thereon. The flap 65a, for example will be weighted so that it will open under a wind velocity of 5 knots; the flap 65b weighted to open at 10 knots and the flap 65c to open at, for example, 15 knots. In operation, with a variable wind blowing, the wind will alternately push the plate 63 inward where its **linear motion will be converted** as described above. If the wind is blowing in short bursts the absence of wind will permit the shaft 33 and plate 63 to return to under the force of the spring described above in preparation for another blast of wind. However, even if the wind is blowing somewhat steadily a reciprocating motion will occur because of the flaps 65. While moving inwardly the differential pressure,

because of the movement, will not be great enough to open all the flaps associated with the particular existing wind velocity. However when the shaft 33 reaches the end of its travel, the wind force will open one or more of the flaps. This will cause the pressures to become unequal and the spring force will tend to return the shaft 33 to its initial position. At some point in its travel the flaps will return to the closed position and the force of the wind will again tend to push the shaft in. The flap action and the amount of reciprocating travel will vary for various wind speeds. However, under all normal conditions, sufficient reciprocation will take place to generate energy as required. Systems can be designated with different types of flaps dependings on the prevailing wind conditions at the location where they are to be used. Also in this regard the pitch of the threads 45 shown on FIG. 5a may also be varied so as to take into account the expected force which will be applied to the input plate 31. That is, if only small forces are to be expected, a long pitch which will require only a small force to rotate the member 47 may be used. On the other hand, if strong wind forces are expected the pitch can be shortened so as to require more force to turn the member 47. Naturally, in the latter embodiment a greater amount of electrical energy will be obtained for the same degree of motion of the shaft 33.

Detailed Description Text - DETX (13):

FIG. 8 illustrates an alternate embodiment for **converting linear to rotary motion**. As shown thereon, the shaft 33 supported by bearings 35 will have formed on its end a rack gear 91 which engages a pinion gear 93 connected through a clutch 95 to a generator 97. As in the embodiment

of FIG. 5, the
clutch will be adapted to engage only when the shaft 33 is moving in the
direction of arrow 99. Also as described above a **flywheel** may be included
between the clutch 95 and generator 97.

Detailed Description Text - DETX (14):
FIG. 9 illustrates the manner in which two shafts 33a and 33b may be driven
by a single plate 31. In this embodiment the plate is mounted for pivotal
motion about a point 101 which may comprise a shaft about which the plate 31 is
supported in conventional bearings for rotation. Only the side of 31a of the
plate is exposed to the wind or other force. The shafts 33a and 33b are
coupled to the plate 31 through suitable flexible couplings 105. Thus motion
of the plate in the direction of arrow 101 will result in motion of shaft 33a
in the direction of arrow 103 and shaft 33b in the direction of arrow 104.
Each of these **linear motions of the shafts 33a and 33b may then be converted** in
the manner described above.

Claims Text - CLTX (5):
d. means for **converting the linear motion** of said shaft into electricity.

Claims Text - CLTX (6):
2. The invention according to claim 1 wherein said means for **converting**
linear motion comprises a linear generator.

Claims Text - CLTX (7):
3. The invention according to claim 1 wherein said means for **converting**
linear motion comprises:

Claims Text - CLTX (8):

a. means to **convert reciprocating linear motion** to rotary motion; and